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Original Article

Inadequate nutritional care for malnourished patients in four university hospitals – The QuaNuT study

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SUMMARY

Background & Aims: Adequate nutritional care to malnourished patients is described as a human right, and recommendations from nutritional care guidelines are legally binding in Norway. The primary objective of this study was to investigate nutritional care in malnourished hospitalized patients. We also wanted to describe the association between malnutrition and length of stay (LOS), readmission, comorbidity and mortality.

Methods: In a cross-sectional, multi-center and quality assurance study, inpatients from four university hospitals across all regional health authorities in Norway were included. The hospital's nutritional care during admission was evaluated according to current malnutrition guidelines. Malnutrition risk screening, assessment for diagnosis and grading severity of malnutrition were performed with Nutritional risk screening 2002 (NRS-2002) and the Global Leadership Initiative on malnutrition (GLIM) criteria. Medical

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records were reviewed to collect data on nutritional support during admission, malnutrition coding, LOS, readmission, comorbidity and 30-days survival after hospital admission.
Results: In our mixed inpatient population (*n* 442, mean age 61 years, 53 % women), 42 % were not adequately screened for risk of malnutrition at hospital admission. Among the 29 % of malnourished patients, only 36 % had documented nutritional support in the medical records, and a malnutrition diagnosis was registered for only 30 %. Malnutrition was associated with LOS, increased comorbidity and reduced 30-day survival.
Conclusion: In this study across all Norwegian regional health authorities, we found a high malnutrition rate and the nutritional care in relation to malnutrition diverged from national and international established guidelines and the framework of national laws and legislation. The findings raise concerns regarding patient safety and potential for improved nutritional care as a human right. Although malnutrition was associated with longer length of hospital stay, comorbidity and reduced 30-day survival, this study does not establish causal relationships.

Introduction

Disease-related malnutrition is a threat to patient safety, as it increases morbidity and mortality rates, and reduces the patients' quality of life [1–6]. General statements most often refer that about 30 % of inpatients are malnourished or at risk of malnutrition. In 2019, the Global Leadership Initiative on Malnutrition (GLIM) criteria were published as the new diagnostic criteria for malnutrition [7]. The GLIM criteria include evaluation of the phenotypic criteria weight loss, body mass index (BMI), muscle mass, and the etiologic criteria reduced food intake, assimilation, or disease burden [7]. The use of the GLIM criteria enables comparison of the prevalence of malnutrition across diagnostic groups, borders, and research disciplines.

Current Norwegian [8] and international guidelines [9,10] for nutritional care in relation to prevention and treatment of malnutrition in hospitals includes; screening for risk of malnutrition, assessment of nutritional status including diagnosis and severity grading of malnutrition, initiation of nutritional treatment for those who can benefit of nutritional support, and communication of nutrition related information to the next care level. In Norway, the recommendations within the national guidelines for nutritional care have been recognized as obligations enshrined in national laws and legislation since 2009. Recently, nutritional care for hospitalized malnourished patients has also been described as a human right, encompassing the right to health and the right to food [11]. Therefore, malnourished patients should receive optimal and timely nutritional treatment when needed, in order to overcome malnutrition related morbidity and mortality. In healthcare settings, it is thus essential to identify and address malnutrition early to ensure patient safety and improve health outcomes. Consequently, in Norway, malnutrition risk screening and assessment to identify these patients is mandatory and should be conducted within 24 hours of admission, and patients at risk should have a plan for adequate nutritional support within 48 hours. Additionally, upon hospital discharge, information regarding nutritional status and -support, along with the severity and corresponding malnutrition diagnosis should be transferred to the next level of care.

Even so, screening patients for risk of malnutrition upon hospital admission and individualized nutritional support is not yet an established routine in all Norwegian hospitals [12–14]. In the present Quality of Nutritional Follow-up and Treatment in Norwegian Hospitals (QuaNuT)-study, we have

investigated the nutritional care, malnutrition rates by the GLIM criteria, and clinical outcomes in a mixed patient population from four Norwegian university hospitals. Thus, the primary objective was to investigate the hospital's adherence to nutritional care in malnourished hospitalized patients. Other outcomes of interest were length of hospital stay, readmission, comorbidity and mortality.

Materials & methods

Study design and setting

This multicenter, cross-sectional quality assurance trial, was conducted from September 2020 to January 2021 at seven selected wards at four Norwegian university hospitals, one in each of the four Regional Health Authorities in Norway (Central, Western, South-Eastern, and Northern Norway). Eligible patients admitted to the participating wards were informed about the ongoing study by the hospital wards' nurses. Members of the project team recruited participants among those who agreed to receive study-information.

Data was collected retrospectively from patients' electronic medical records on two occasions (Figure 1). The first time point was chosen to collect data on screening and grading of malnutrition and nutritional support according to the nutritional care guidelines. The second time point was chosen to collect data on length of hospital stay, readmission, comorbidity and mortality. Collected data on nutrition care included data on screening for risk of malnutrition, assessment of nutritional status including diagnosis and severity grading of malnutrition, initiation of nutritional support, and communication of nutrition-related information to the next care level. In addition to collecting data from the patients' medical records, the members of the project team screened the patients with NRS-2002 if this had not been completed or carried out by the hospital staff, used GLIM to rate and determine the severity of malnutrition, and administered data collection with use of the Patient-Generated Subjective Global Assessment (PG-SGA).

Study population

Inclusion criteria for participating were patients aged 18 years and older, hospitalized between 24-120 hours at inclusion. Both medical and surgical patients were included. Exclusion criteria were a life expectancy of less than six months (as evaluated by the ward staff), a diagnosis of dementia or anorexia

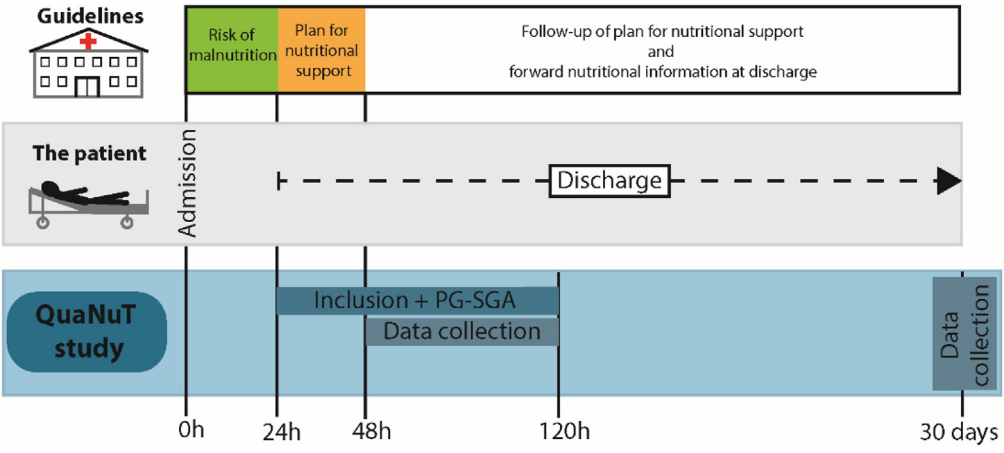

Figure 1. Illustration of the guidelines for nutritional care related to malnutrition in a hospital, a hospitalized patient, and the data collection in the QuaNuT study.

nervosa, being in isolates or having increased infection control measures, undergoing a bone marrow transplant, as well as being pregnant, lactating, and non-Norwegian speaking.

Data collected from the medical records

To assess compliance with current guidelines for nutritional care, we collected patient data from the electronic medical records including sex, age, weight, height, and detailed information on malnutrition risk screening and support initiation within the first 24 and 120 hours after hospital admission, respectively (Figure 1). After 30 days, we conducted retrospective data collection from the medical records. This included information on the transfer of nutritional data from hospital to the next level of care, ICD-10 codes assigned by the hospital staff, length of the current hospital stay, comorbidities, the presence of palliative treatment (yes/no), the highest CRP concentration, and any occurrence of readmissions or mortality within the 30-day period following admission.

Nutritional Risk Screening 2002 (NRS-2002)

According to the national guidelines for nutritional care to prevention and treatment of malnutrition, NRS-2002 was implemented in adherence to standard protocols across all hospitals. To determine the proportion being screened for risk of malnutrition upon hospital admission, we collected available NRS-2002 data from the medical records. Both the individual question scores and the total point score from the NRS-2002 screening were collected. Risk of malnutrition was identified with a total NRS-2002 score of ≥ 3. If the hospital staff had not completed or had incorrectly filled out the NRS-2002, the researchers completed the NRS-2002 when possible, in order to ensure assessment in all included patients.

ICD-10 codes for malnutrition

According to the national guidelines, in addition to diagnosing malnutrition upon hospital admission, an ICD-10 code for malnutrition should be set when identified, similar to other medical conditions. We collected data on the following ICD-10 codes for malnutrition in the patient's medical records from discharge: E46 (Unspecific protein-calorie malnutrition), E44 (Protein-calorie malnutrition of moderate and mild degree) or E43 (Unspecified severe protein-calorie malnutrition) and subcodes for all the three ICD-10 codes.

Patient-generated Subjective Global Assessment (PG-SGA)

The Patient-Generated Subjective Global Assessment (PG-SGA) was administered by the study researchers. A translated and culturally adapted version of PG-SGA that has previously been validated for the Norwegian setting was used [15].

Diagnosis of malnutrition, GLIM criteria

We used the GLIM criteria to define the rate and grading of malnutrition among all the patients included. The indicators required to diagnose malnutrition by GLIM, were obtained from the patients' medical record and the PG-SGA. Patients who fulfilled at least one phenotypic AND at least one etiologic criterion were defined as malnourished [7].

Phenotypic criteria for the diagnosis of malnutrition

Low BMI was defined as < 20 kg/m^2 for patients aged 18–69 years, while for patients ≥ 70 years of age it was defined as BMI < 22 kg/m^2 [7]. The participant's weight and height from the current admission were obtained from the electronic medical record and used to estimate BMI. In cases where the participant had not been weighed upon admission, the researchers weighed the participant, using a digital weight at the ward.

Unintentional weight loss was based on self-reported weights stated by the participants in the PG-SGA form (current weight, weight one month ago, and weight six months ago). To fulfill the criterion of weight loss, the unintentional weight loss had to be > 5 % within the last 1–6 months.

Reduced muscle mass was based on the physical exam in the PG-SGA (worksheet 4). However, in some instances the physical exam could not be performed due to the covid-19 pandemic, because the patient refused, or had a severely reduced general condition. Moreover, due to the covid-19 pandemic, the physical exam was performed without touching the face or hands of the patients, and close physical contact (within 1 meter distance) was limited to a maximum of 5 minutes. As an alternative to a complete physical exam, the assessment of muscle mass was evaluated with a combination of visual inspection, patient self-assessment guided by the researcher, and dialog with the patents regarding current and previous muscle mass. The dialog covered questions about e.g. clothing, watches, rings, belts; observable declines in strength or function; and noticeable visual changes in muscle size.

Etiologic criteria for the diagnosis of malnutrition

We defined inflammation as present if CRP was > 10 mg/L at any time during the current hospital stay.

We defined reduced food intake or assimilation as:

reporting a food intake less than normal in the PG-SGA (box 2. The box 2 question reads: "As compared to my normal intake, I would rate my food intake during the past month as: unchanged; more than usual; less than usual" [15]. This question has been found to correspond well with energy intake [16].

OR presence of the following nutrition impact symptoms reported in PG-SGA (box 3): "vomiting", "diarrhea", "constipation", "dysphagia" or "nausea"; OR any of the following WHO ICD-10 codes within "Diseases of the digestive system" category (K-codes) documented in the electronic medical record as either main or secondary diagnosis: K22.2, K22.5, K31.5 (diseases of oesophagus, stomach and duodenum), K52.3 (noninfective enteritis and colitis), K55.8, K56.0, K56.6, K56.7, K59.0 (other diseases of the intestines), K71.2 (diseases of the liver), K80.1, K83.0, K83.1 (diseases of the gallbladder, biliary tract and pancreas), K92.2 (other diseases of the digestive system).

Grading the severity of malnutrition

Within the group of malnourished patients, the phenotypic criteria of low BMI and weight loss were used to differentiate between moderate and severe malnutrition as defined in GLIM [7]. Patients aged 18–69 years were considered severely malnourished if BMI was < 18.5 kg/m2. In patients ≥ 70 years, severe malnutrition was defined if BMI was < 20 kg/m2 OR unintentional weight loss was > 10 % within the last 6 months. Patients who met the criteria for malnutrition but did not fulfill the malnutrition criteria for severe malnutrition were defined as moderately malnourished.

Ethical statement

This study was conducted according to the guidelines in the Declaration of Helsinki. The QuaNuT-study is a quality research trial and therefore exempted from review by the Regional Committees for Medical and Health Research Ethics (REK no. 138684). The Norwegian Centre for Research Data (NSD no. 323798), data protection officers at the University of Oslo (no. 10/17091), the included university hospitals and the department managers from the individual wards recommended the study and the procedures for informed consent and data security. Participation in the project was voluntary, and written informed consent was obtained from all patients included.

Statistical analysis

Since the primary aim in this study was to explore the nutritional care in malnourished hospitalized patients, rather than hypothesis testing, no *a priori* sample size calculation was made. Regarding data on readmission, morbidity and mortality, we consider this study as a pilot study to obtain variability for future investigation in Norway. Power calculation was thus not performed on these outcomes. Normally distributed data were presented as mean (standard deviation (SD)), and non-normally distributed data as median (interquartile range (IQR)) or median (minimum, maximum). Categorical variables

were presented as frequencies (percentages), and Pearson Chi-Square test or Fisher's Exact test (for low numbers) were used to identify differences between groups. For continuous data, Mann-Whitney U Test was used to identify possible differences between groups. In addition, we used the Kaplan-Meier survival function to plot the overall survival within 30 days from admission based on malnutrition status, and potential differences in survival based on malnutrition status were tested by Log-rank test. All tests were two-sided and *P* values less than 0.05 were considered statistically significant.

Results

At seven selected wards at four Norwegian university hospitals, 539 patients were informed about the study, 465 (86 %) consented to participate, and 442 (82 %) patients were included (Figure 2). Throughout the recruitment period, the total number of admissions across all wards was 1932 (Figure 2), and the most frequently known reason for non-eligibility was a short length of stay (<24 hours). Most patients were enrolled at the hospitals in Central (*n* 138, 31 %) and Western (*n* 118, 27 %) Norway, and an equal proportion of patients were included from the South-Eastern (*n* 94, 21 %) and the Northern Norway (*n* 92, 21 %) hospitals.

Patient characteristics

Among the 442 participants included in this study, 53 % were women and the median (IQR) age was 65 (21) years. The mean (SD) BMI at hospital admission was 25.9 (5.1) kg/m^2. Based on the ICD-10 code assigned during the current hospital stay, the most common primary ICD-10 diagnosis in this population was cancer, with 51 % of the patients receiving it as their primary diagnosis. None of the participants had malnutrition as the primary diagnosis. The median (IQR) length of hospital stay was 4 (4) days. Further participant characteristics, including comorbidities, are detailed in Table 1.

Nutritional care

Screening for risk of malnutrition

Despite it being a mandatory procedure to be completed within the first 24 hours, 26 % were not screened for risk of malnutrition upon hospital admission. Of those who were screened (74 %), in 22 % the NRS-2002 form was either incorrectly or incompletely filled out by hospital staff. Consequently, a significant proportion of patients (42 %) were not adequately screened for the risk of malnutrition upon hospital admission.

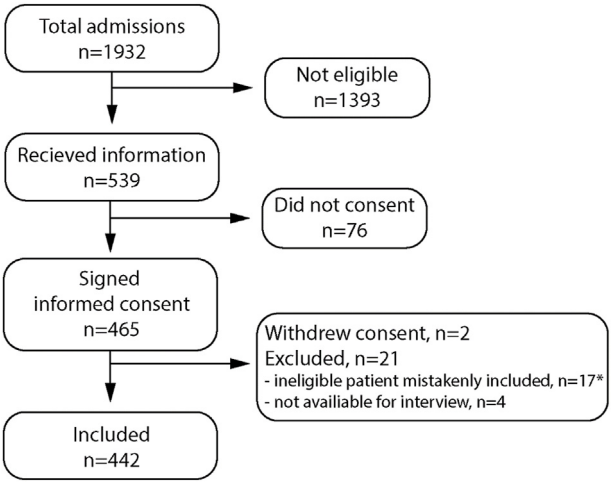

Figure 2. Flow chart for inclusion of patients. *Due to e.g. shorter and longer hospital stay.

Table 1
Characteristics of the study population (n=442)

Variable	
Women, *n* (%)	235 (53 %)
Men, *n* (%)	207 (47 %)
Age (years), median (IQR)	65 (21)
BMI (kg/m^2), mean (SD)[a]	25.9 (5.1)
Length of stay (days), median (IQR)	4 (4)
Under palliative treatment (yes), *n* (%)	70 (16)
CRP (mg/L), median (IQR)[b]	13 (62)
Primary ICD-10 diagnosis[c]**, *n* (%)**	
Cancers (C00–C96)	224 (51)
Benign neoplasms (D00-D49)	22 (4)
Nervous system (G00-G99)	41 (9)
Circulatory system (I00–I99)	23 (5)
Musculoskeletal & connective tissue (M00-M99)	23 (5)
Abnormal clinical and laboratory signs (R00-R99)	20 (5)
Digestive system (K00–K95)	19 (4)
Certain infectious and parasitic diseases (A00-B99)	11 (3)
Other categories[d]	59 (13)
Most common comorbidities[c] ***n* (%)**	
CVD risk factors and diseases[e]	254 (57)
Musculoskeletal diseases	110 (25)
Gastrointestinal-related diseases	63 (14)
Diabetes Mellitus type 1 and 2	50 (11)
Pulmonary diseases	42 (10)
Hypothyroidism	28 (6)
Kidney and liver diseases	27 (6)
Mental disorders	23 (5)
Neurological diseases[f]	19 (4)
Infectious or parasitic diseases	12 (3)
Other comorbidities	14 (3)
Number of comorbidities, median (min-max)	1 (0–10)
Previous cancers, *n* (%)	77 (17)

[a] BMI, body mass index.
[b] CRP, C-reactive protein.
[c] from the current hospital stay.
[d] D50-D89, E00-E89, F01–F99, H00–H95, J00-J99, L00-L99, N00–N99, Q00-Q99, S00-T88, Z00-Z99.
[e] coronary disease, arrhythmias, cerebrovascular stroke, transient ischemic attack, pulmonary embolism, aneurysms, vascular disease, hypertension, hypercholesterolemia.
[f] migraine and epilepsy.

To facilitate an investigation on nutritional care in hospitalized patients, the research staff identified and screened patients with incorrectly and incompletely filled out NRS-2002 screening for risk of malnutrition. Among the patients included in this study, 28 % were identified as being at risk of malnutrition. For more detailed information see Table 2.

Malnutrition diagnosis and grading according to the GLIM criteria

The GLIM criteria were used to determine the prevalence and severity of malnutrition among all the patients included. According to the GLIM criteria, 29 % of the patients were identified as malnourished, with 23 % being categorized as moderately malnourished and 6 % as severely malnourished. The remaining patients (71 %) were considered as not malnourished. The number of patients fulfilling the various phenotypic and etiological criterion for the diagnosis of malnutrition are further outlined in Table 3.

Nutritional support

Among the patients identified as moderately and severely malnourished (29 %), documentation of nutritional support in the medical records was found only in 36 % of the cases, with oral nutritional

Table 2
Rate and results of Nutritional risk screening (NRS-2002) at hospital admission (n=442)

Rate of screening for malnutrition, *n* (%)	**435 (98)**
Screened by hospital staff	327 (74)
Of which incorrectly or incomplete screening by hospital staff	71 (22)
Not screened by hospital staff	115 (26)
Missing data	7 (0.2)
Results of the NRS-2002 screening, *n* (%)	**435 (98)**
At risk of malnutrition (score $\geq$ 3)	123 (28)
Not at risk of malnutrition (score $\leq$ 2)	312 (71)
Missing data	7 (0.2)
NRS-2002 point score, mean (SD)	1.7 (1.5)

Table 3
Malnutrition identified and categorized by the Global Leadership Initiative on Malnutrition (GLIM) criteria, and its distribution according to etiological and phenotypic criteria (n=442).

Malnourished upon hospital admission, *n* (%)	**128 (29)**
Moderately malnourished	103 (23)
Severely malnoutrished	25 (6)
Phenotypic criterion, *n* (%)	**155 (35)**
Low BMI[a]	70 (16)
Unintentional weigh loss[b]	105 (24)
Reduced muscle mass[c]	49 (11)
Etiologic criterion, *n* (%)	**299 (68)**
Reduced food intake/reduced food assimilation:	
Food intake less than normal (PG-SGA[d])	174 (39)
Vomiting, diarrhea, dysphagia, or constipation	133 (30)
Inflammation (CRP[e] over 10 mg/L)	189 (43)
Selected WHO[f] ICD-10[g] diagnosis[h]	20 (5)

[a] Low BMI, Body Mass Index, defined as < 20 kg/m2 (age 18–69 years) and < 22 kg/m2 (age $\geq$ 70 years).
[b] Defined as > 5 % the last 1–6 months.
[c] Based on physical or research guided assessment according to.
[d] Patient-Generated Subjective Global Assessment (PG-SGA) tool.
[e] CRP, C-reactive protein.
[f] WHO, World Health Organization.
[g] ICD-10, International Statistical Classification of Diseases and related Health Problems.
[h] Includes the following diagnosis in the K-category: K22.5; K31.5; K83.0; K55.8; K52.3; K56.7; K56.0; K71.2; K80.1; K92.2; K83.1; K59.0; K56.6; K22.2 as either main or secondary diagnosis.

supplement as the most common nutritional support provided (29 %). In only 9 % of the malnutrition cases, a registered dietitian had been involved. Nutritional support is further described in Table 4.

Documentation of malnutrition and transfer of nutritional-related information

Among the majority (70 %) of patients with malnutrition upon hospital admission, no ICD-10 codes for malnutrition were documented in the medical records at hospital discharge. However, among the subset of patients with a documented malnutrition diagnosis in the medical record (30 %), 8 % had the ICD-10 diagnosis code E43 for severe malnutrition, 10 % had E44 for moderate malnutrition, and 12 % had E46 (unspecific protein-calorie malnutrition) recorded (Table 4).

Nutrition-related information was transferred to the next level of care upon hospital discharge in nearly half of the population with malnutrition (48 %). The most common nutritional information transferred were the ICD-10 codes for malnutrition (31 %), nutrition-related symptoms (29 %) and body weight (22 %). A more comprehensive overview of nutrition-related information transferred upon hospital discharge in patients with and without malnutrition can be found in Table 4.

Table 4
Documentation of nutritional care in patient record during hospital stay and transfer at discharge (n=442).

	Malnourished patients (n=128)	Non-malnourished patients (n=314)
Nutritional support[a] during hospital stay[b], n (%)	46 (36)	59 (19)
Modified diet[c]	5 (4)	5 (2)
Oral nutritional supplement	37 (29)	53 (17)
Tube feeding	5 (4)	7 (2)
Intravenous nutrition	5 (4)	3 (1)
Consulted by registered dietitian	12 (9)	9 (3)
Nutrition-related information transferred to next care level, n (%)	62 (48)	64 (20)
NRS-2002[d]	4 (3)	1 (0.3)
Body weight	22 (17)	30 (10)
Energy intake[e]	11 (9)	13 (4)
Energy need	4 (3)	1 (0.3)
Protein need	1 (1)	0
Nutrition-related symptoms	29 (23)	16 (5)
Nutritional support	20 (16)	22 (7)
ICD-10 codes for malnutrition	31 (24)	10 (3)
Documentation from registered dietitian	5 (4)	0
No nutrition-related information transferred	64 (50)	247 (79)
Missing data	2 (2)	3 (1)
ICD-10 codes recorded in patient's record at discharge, n (%)	38 (30)	8 (3)
E43, unspecified severe protein-calorie malnutrition	10 (8)	1 (0.3)
E44, protein-calorie malnutrition, moderate/mild	13 (10)	1 (0.3)
E46, unspecific protein-calorie malnutrition	15 (12)	8 (3)
No ICD-10 code for malnutrition	90 (70)	303 (95)

[a] Nutritional support includes modified diet OR oral nutritional supplement OR tube feeding OR intravenous nutrition.
[b] Nutritional support documented in the patient medical record.
[c] Modified diet includes e.g. energy- and protein dense diet, therapeutic diet, texture modified diet.
[d] NRS-2002, Nutritional Risk Screening 2002 risk category and/or score.
[e] Any description of energy intake which was found in the transfer documents was accepted and included.

Clinical and other outcomes

The 30-days mortality rate was 7 % among the malnourished and 1 % for the non-malnourished (Table 5). Also, the Kaplan-Meier curves for survival showed increased rate of deaths among malnourished patients as compared to non-malnourished patients (Log rank test $P<0.001$) (Figure 3A), and for severe malnutrition versus not severe malnutrition (Log rank test $P=0.003$) (Figure 3B). Furthermore, as shown in table 5, malnourished patients had significantly longer length of stay, higher CRP-values and more comorbidities. Also, the recorded hospital stay was more likely to be a readmission, as compared to the non-malnourished patients.

Patients with cancer

Since approximately half (51 %) of our patients had a cancer diagnosis, we investigated the frequency of malnutrition among patients with cancer compared to all other diagnoses. Malnutrition was significantly more common among patients with cancer (*n* 83, 37 %) as compared to patients with other diagnoses (*n* 45, 21 %) ($P< 0.001$) (Supplementary table 1). The variance in malnutrition was primarily driven by differences in the number with moderate malnutrition, as the prevalence of severe malnutrition was similar between the groups (Supplementary table 1). Also, the median (IQR) CRP was higher (30 (83) vs 4 (26) mg/L), length of stay was longer (5 (7) vs 3 (3) days), and nutritional support was given significantly more often to patients with cancer as compared to the patients with other main diagnoses (31 % vs 17 %).

Table 5
Clinical and other outcomes among the patients according to malnutrition status defined by the Global Leadership Initiative on Malnutrition (GLIM) criteria (n=442).

	No malnutrition	Malnutrition	Moderate malnutrition	Severe malnutrition	Not *vs* malnourished	Severe malnutrition *vs* all others[a]
	(n=314)	(n=128)	(n=103)	(n=25)	*P*	*P*
30-day mortality, n (%)	3 (1 %)	9 (7 %)	6 (6 %)	3 (12 %)	<0.001[b]	0.025[b]
Hospital readmission, n (%)	29 (8 %)	19 (15 %)	17 (17 %)	2 (8 %)	0.086[c]	1.000[c]
Current stay is a readmission, n (%)	28 (8 %)	22 (17 %)	15 (15 %)	7 (28 %)	0.013[c]	0.015[b]
Length of stay, median (IQR)	3.5 (3)	5 (5)	5 (5)	5.5 (6.25)	<0.001[d]	<0.001[d]
Number of comorbidities, median (IQR)	1 (2)	2 (3)	2 (3)	4 (2)	<0.001[d]	<0.001[d]
CRP mg/L, median (IQR)	7 (43)	38 (111)	36 (107)	54 (130)	<0.001[d]	<0.001[d]

[a] All others includes being not and moderate malnourished.
[b] Fisher 's Exact test.
[c] Pearson Chi-Square.
[d] Mann-Whitney Test.

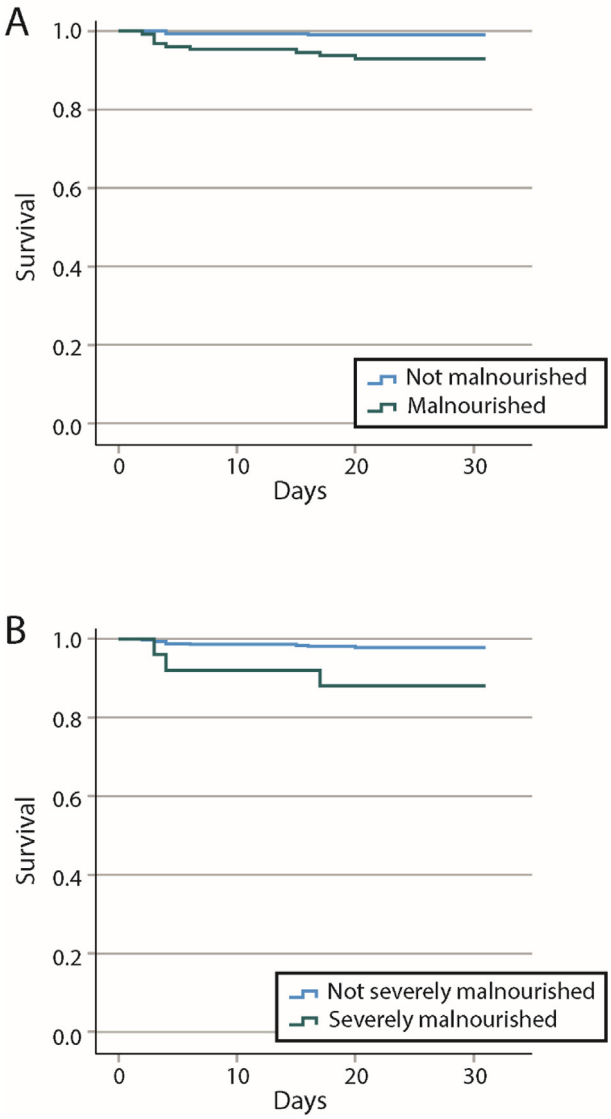

Figure 3. Survival curves based on malnutrition and severe malnutrition. Kaplan-Meyer plots for A) malnourished (n = 128) versus not malnourished patients (n= 314) (Log rank test $P<0.001$), B) Severe malnutrition (n= 25) versus not severe malnutrition (n=417) (Log rank test $P=0.003$). Malnutrition diagnosis and severity were based on GLIM criteria.

Discussion

In a mixed inpatient population, where one-third of the patients were malnourished upon hospital admission, there was a lack of adherence to regulatory standards regarding malnutrition screening. Further, in only one-third of the malnourished patients were we able to find documentation supporting that nutritional care was given in accordance with the guidelines for malnutrition during admission or when discharged from hospital. Malnutrition was associated with reduced 30-day survival, longer

length of stay, and more frequent comorbidities. Compared to patients with non-cancer diagnoses, those with cancer diagnoses exhibited higher rate of malnutrition, elevated levels of CRP, longer hospital stays, and received nutritional support more frequent. Overall, the nutritional care in malnourished patients did not align with guidelines and national laws and legislation, and this raises concerns about patient safety.

Risk of malnutrition is highly prevalent in hospitalized patients. Therefore, the implementation of systematic screening for risk of malnutrition at hospital admission is crucial to promptly identify at-risk patients and initiate appropriate interventions. Thus, it is disappointing that only about half of the patients included were correctly screened with NRS-2002 upon admission, despite that screening for risk of malnutrition has been mandatory since 2009. At the individual patient level, diagnosing malnutrition and providing early nutritional intervention are particularly important to improve patient outcomes, such as preventing readmissions, reducing prolonged hospitalizations, enhancing quality of life, and reducing morbidity and mortality, all of which are associated with malnutrition [1–6]. The number of patients being screened for malnutrition upon hospital admission is in line with previous findings in Norwegian hospitals [17]. Although we cannot rule out the possibility that the malnutrition screening rate was influenced by the covid-19 pandemic, we believe that the impact was not significant, especially considering the specific wards included in our study.

In Norway, all healthcare personnel share a common responsibility for nutritional support, starting with identifying malnourished patients upon admission. However, if malnutrition is neither diagnosed nor communicated to other health and care services, as observed in approximately half of the malnourished patients in this study, we believe the nutritional routine is not tailored to meet the patients' needs. The recognition of nutritional care as a human right for hospitalized patients emphasizes the importance of preventing malnutrition-related morbidity and mortality [11,18]. This right implies mandatory screening for risk of malnutrition, followed by nutritional assessment, diagnostics, and personalized care as needed. Further, the majority of recommendations in the Norwegian Guidelines for treatment and prevention of malnutrition are enshrined in the Norwegian law or legislation [19]. Even with these guidelines and legislation in place, our findings reveal that most malnourished patients lack nutritional support the first 3–5 days of hospitalization and the length of hospital stay is longer in this patient group. These findings indicate that nutritional care in Norwegian hospitals deviate from nutritional care as a human right, and from both Norwegian and international guidelines. Known barriers for good nutritional practice are the lack of: clearly defined responsibilities; sufficient nutritional education; patient influence; and involvement by the hospital management [20]. The barriers may vary between sites, however all these barriers must be overcome, in order to successfully implement overall good nutritional practice.

In Norwegian hospitals, malnutrition diagnosis and severity grading traditionally rely on national adaptations of ICD codes, and national statistics show infrequent use of ICD-10 codes for malnutrition in hospitalized patients. Despite international recommendations for GLIM criteria adoption, implementation in Norwegian hospitals remains limited. While not mandated by Norwegian law, the choice to use GLIM criteria in the present study, aligns with international consensus on malnutrition diagnosis and enables comparison between studies. Further, our findings are consistent with previous studies that utilized GLIM or NRS-2002, indicating an association between malnutrition and readmissions, and higher mortality [21], but due to the study design, we cannot establish a cause- and-effect relationship. However, in a mixed inpatient population included in the EFFORT-trial, 62 % of the patients were malnourished according to a modified version of GLIM, and malnutrition was associated with adverse clinical outcomes and similar to our findings, to increased mortality [22]. We have previously shown that the proportion of malnourished patients according to GLIM varies depending on the screening tool used prior to applying the GLIM-criteria [23]. Therefore, it is of importance to identify and report the number of patients qualifying for a GLIM-malnutrition diagnosis, even without prior screening. Unlike the EFFORT trial, where only patients in risk of malnutrition were included, we included any hospitalized patient with an expected survival over 6 months. Consequently, our lower malnutrition rate may be attributed to the inclusion criteria, and our study population may provide a more representative group of hospitalized patients overall. Our malnutrition rate is aligned with the findings in a large cross-sectional study in Germany, where 27 % of a general hospitalized population were malnourished according to Subjective Global Assessment (SGA), another tool for diagnosing

malnutrition [24]. Screening and diagnosis are two separate and different entities, which both serve important and separate functions. Therefore, to increase the knowledge about malnutrition rates, and enable malnutrition rates across studies and boarders and independently of risk screening, we need large scale studies utilizing the GLIM-criteria, with and without prior screening. Specifically, studies should include general hospital populations.

Few malnutrition-related ICD-10 codes (E43, E44 or E46) were found in the electronic patient records of malnourished patients at discharge. The utilization of these codes is essential for hospitals, governments, regional health authorities, and others to assess the prevalence of malnutrition and allocate appropriate healthcare resources. A potential consequence of underestimating malnutrition due to absence of these codes in medical records is incomplete understanding of the problem among health providers, resulting in lack of awareness. This lack of awareness can have a negative effect on resource allocation, nutritional care and healthcare costs. Inadequate documentation of nutritional support and the lack of malnutrition ICD-codes used in this study may also reflect a low referral-rate to registered dietitians, given that only one out of ten malnourished patients received consultation with a registered dietitian. Although the utilization of malnutrition-related ICD-10 codes is generally low in both the US and European countries, there is a growing trend in their usage [25–27]. Understanding the barriers associated with the use of these diagnosis codes is crucial for enhancing nutritional care in hospitalized patients.

There are limitations to our study that merit discussion. Our data collection was performed during the covid-19 pandemic, with restricted access to hospitals and limited physical contact with patients. Thus, identifying reduced muscle mass required adapted methods as recommended for telenutrition [28]. The physical exam was performed with minimal physical contact, such as visual inspection of muscle mass, patient self-assessment guided by the researcher, and dialog with the patients regarding current and previous muscle mass. The GLIM community recently endorsed physical exam as a proxy for reduced muscle mass, when methods for direct measurement of muscle mass are not available, as often occurs in clinical practice [29].

Our study focused on patients from specific departments with hospital stays exceeding 24 hours, excluding Covid-19-specific units and patients in isolation or with heightened infection control measures. Thus, we do believe that our patient populations are representative for those patients with hospital stays over 24 hours from their respective departments. Even though the general workload in the hospitals was increased during the covid-19 pandemic, we have no reason to believe that daily practice and usual care in the selected wards were highly affected. However, a possible selection bias arises from the challenge of including a representative sample, as the most vulnerable patients are often not included. Despite these factors, adherence to national guidelines for prevention and treatment of malnutrition should have been followed.

Secondly, our study has representation of all the regional health authorities within Norway, however, being a single country study, the generalizability beyond Norwegian hospitals is uncertain. Lastly, our data on nutritional support are drawn from the electronic patient records. We cannot rule out that additional nutritional support was given without proper documentation.

Conclusion

In this study across all Norwegian regional health authorities, malnutrition rates were high, especially among patients with cancer. The presence of malnutrition was associated with reduced 30-day survival, longer length of stay, and more frequent comorbidities. Nutritional care diverged from national and international established guidelines and the framework of national laws and legislation. The findings raise concerns regarding patient safety and nutritional care as a human right, and show a potential for improvement in Norwegian Hospitals.

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Author contribution

IO and IP: Conceptualization, Methodology, Software, Formal analysis, Data Curation, Writing - Original Draft, Visualization, Supervision, Project administration.
LT: Conceptualization, Methodology, Resources, Writing - Review & Editing, Supervision.
RJT and SHF: Conceptualization, Methodology, Writing - Review & Editing, Supervision.
PH: Conceptualization, Writing - Review & Editing, Supervision.
MMA, SF, MWG, NAH, IHO, IS, HH: Methodology, Investigation, Writing - Review & Editing,
RA, ILM, SH, KYKL, AH: Resources, Writing - Review & Editing.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: IO, LT, RJT, SHF, PH, MMA, SF, MWG, NAH, IHO, IS, HH, RA, ILM, SH, AH, IP declare no conflicts of interest. KYKL has participated on a Data Safety Monitoring Board or Advisory Board for Eisai, MSD, Nycode, Astra Zeneca and GSK (all payed to the institution), recieved honoraria from Eisai, and is Deputy Medical Directors of the non-profit organization Nordic Society Of Gynaecologic Oncology - Clinical Trial Unit (NSGO-CTU).

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.nutos.2024.01.002.

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